SPECIES OF *ATTENUATELLA* STEHLI (BRACHIOPODA) FROM NEW SOUTH WALES

JOHN ARMSTRONG AND PETER TELFORD
Department of Geology, University of Queensland

(Plate x)

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Synopsis

Attenuatella convexa Armstrong and *Attenuatella* sp. cf. *A australis* Armstrong and Brown are recorded from the Farley Formation in the Sydney Basin, New South Wales thereby strengthening the correlation of the fauna in this unit with Dickins Fauna II in Queensland. *Attenuatella multispinosa* Waterhouse from the Gilgurry Mudstone in northern New South Wales is considered to be closest to *A. incurvata* Waterhouse from the AG 4 Limestone in New Zealand. Species occurring in the Gilgurry Mudstone with *A. multispinosa* include *Strophalosia ovalis* Maxwell, *Cancrinella magniplica* Campbell, *Ingelarella* sp. cf. *I. mantuanensis* Campbell, and *Notospirifer* sp. cf. *N. minutus* Campbell. The occurrence of *Attenuatella multispinosa* with these species supports the correlation of the fauna in the Gilgurry Mudstone with New Zealand faunas that contain *A. incurvata.*

INTRODUCTION

The occurrence of *Attenuatella convexa* Armstrong and *Attenuatella* sp. cf. *A. australis* Armstrong and Brown in the Farley Formation is the first record of the spiriferid *Attenuatella* in the Sydney Basin. Waterhouse (1967*a*) has described *Attenuatella multispinosa* Waterhouse from the Gilgurry Mudstone in northern New South Wales and representatives of *Attenuatella* are quite common in Queensland (Armstrong and Brown, 1968; Armstrong, 1968). The fauna occurring with *Attenuatella convexa* and *Attenuatella* sp. cf. *A. australis* in the Farley Formation includes *Anidanthus springsurensis* (Booker) (UQF52687–8) recorded by Armstrong, Dear, and Runnegar (1967, p. 90), *Ingelarella ovata* Campbell (UQF54448), and *I. branxtonensis* (Etheridge) (UQF54449–50). Farley Formation is the amended name proposed by Booker (1960, p. 15) for rocks which David (1907, 1950) included in his Farley Stage. Species occurring at other localities in the Farley Formation are listed by Armstrong *et al.* (1967, p. 90). Many of these species are characteristic of the fauna of the Tiverton Formation (i.e. Fauna II of Dickins, 1964) in Queensland, and for this fauna Armstrong *et al.* (1967, p. 91) suggest a lower Artinskian (Aktastinian) age. In Queensland *Attenuatella convexa* is known from two localities (Armstrong, 1968) at both of which there is a diverse Fauna II. The occurrence of *Attenuatella convexa* in the Farley Formation strengthens the correlation of the fauna in this unit with Fauna II in Queensland.

A number of specimens of *Attenuatella multispinosa* Waterhouse have recently been collected from two localities (UQL3270 and UQL3272) in the Gilgurry Mudstone in northern New South Wales. Each of these localities is at approximately the same stratigraphic level. The fauna from a locality (UQL3271) near the base of the Gilgurry Mudstone about 1,700 feet stratigraphically below UQL3270 includes *Cancrinella magniplica* Campbell (UQF54427), *Strophalosia ovalis* Maxwell (UQF54431–32), and *Notospirifer* sp. cf. *N. minutus* Campbell (UQF54416). Faunas from approximately the same stratigraphic level as the localities which yielded the specimens of

Attenuatella multispinosa include *Ingelarella* sp. cf. *I. mantuanensis* Campbell (UQF56068 from UQL3318; UQF56066 from UQL3317) and *Notospirifer* sp. cf. *N. minutus* Campbell (UQF56067 from UQL3317).

Repositories and localities.—Mentioned and figured specimens which are retained in the collections of the Australian Museum, Sydney and in the Department of Geology, University of Queensland are designated by a number prefixed by AMF and UQF respectively. Localities indexed at the latter institution are denoted by a number prefixed by UQL.

All of the localities in the Gilgurry Mudstone which are mentioned in the text are on the Drake 1: 63,360 map (1946 reproduction). The descriptions and grid references of the localities on this map are as follows:

UQL3270: on east side of Slaty Creek, 400 yards at 35° east of north from the Sandy Hill to Drake road crossing of Slaty Creek. 356E 173N.

UQL3271: hill slope on north side of Slaty Creek about 1900 yards at 30° east of north from the Sandy Hill to Drake road crossing of Slaty Creek. 363E 186N.

UQL3272: road cutting on the road from Sandy Hill to Drake at 398E 152N.

UQL3317: in creek 200 feet north of the road from Sandy Hill to Drake at 375E 162S.

UQL3318: exposures in small creek which is first creek, to the south of the Drake to Sandy Hill road crossing of Crooked Creek, to enter Crooked Creek from the east. 308E 157S.

The locality from which the Farley Formation specimens of *Attenuatella* were collected is UQL3265 which is the north western corner of Portion 74, Parish Pokolbin, County Northumberland, New South Wales.

Systematic Description

Phylum Brachiopoda Duméril, 1806
Order Spiriferdia Waagen, 1883
Subfamily Ambocoeliinae George, 1931
Genus *Attenuatella* Stehli, 1954

Attenuatella Stehli, 1954. *Attenuatella* Stehli; Chernyak, 1963. *Attenuatella* Stehli; Waterhouse, 1964. *Attenuatella* Stehli; Waterhouse, 1967*a*. *Attenuatella* Stehli; Armstrong and Brown, 1968. *Attenuatella* Stehli; Waterhouse, 1968. *Attenuatella* Stehli; Armstrong, 1968. *Attenuatella* Stehli; Beznosova, 1968.

Type species.—(original designation) *Attenuatella texana* Stehli, 1954, Pl. 25, figs 31–33, from the Lower Leonardian Bone Spring Formation, Texas.

Other species and specimens.—*A. acutirostrus* (Krotova, 1885), Pl. 4, fig. 24. *A. stringocephaloides* (Chernysheva and Likharev) *in* Likharev and Einor, 1939, Pl. 13, fig. 5a, b. *A. attenuata* (Cloud, 1944), Pl. 17, figs 22–25. *A. stringocephaloides* (Chernysheva and Likharev); Chernyak, 1963, Pl. 42, figs 3, 4. *A. taimyrica* Chernyak, 1963, Pl. 42, figs 5–9. *A. incurvata* Waterhouse, 1964, Pl. 20, figs 1–12, Pl. 21, figs 1–9. *A. multispinosa* Waterhouse, 1967*a*, Pl. 24, figs 1–7. *A. australis* Armstrong and Brown, 1968, Pl. 8, figs 1–16. *A. altilis* Waterhouse, 1968, Pl. 2, figs 2–12, 15. *A. convexa* Armstrong, 1968, Pl. 142, figs 1–12, 19. *A.* sp. cf. *A. incurvata* Waterhouse; Armstrong, 1968, Pl. 142, figs 13–18. *Attenuatella* sp. A. Armstrong, 1968, Pl. 142, figs 20–23. *Attenuatella* sp. Landis and Waterhouse, 1966, Pl. 1, figs 1–5. *Attenuatella* sp. Landis and Waterhouse, 1966, p. 144. *Attenuatella* sp. Armstrong, 1968,

Pl. 142, figs 24–26. (?) *A. elgae* Beznosova, 1968, Pl. 29, figs 1–3. A. sp. cf. *A. australis* Armstrong and Brown, (herein). *A. convexa* Armstrong, (herein). *A. multispinosa* Waterhouse, (herein).

ATTENUATELLA CONVEXA Armstrong, 1968.

Specimens.—UQF54451–53, UQF54455–58 from the Farley Formation in the Sydney Basin, New South Wales at UQL3265 in the north-western corner of Portion 74, Parish Pokolbin, County Northumberland.

Description.—The shell of the Farley specimens is gently bi-convex and variably transverse. Ventral valves are relatively broad and they bear a narrow but distinct sulcus for their entire length. Flanks of the ventral valves are smooth and towards the commissure are rather steep. The dorsal valve is semicircular in outline although the length of the cardinal margin is slightly less than the greatest width of the valve. One dorsal valve is gently convex (Pl. X. fig. 4). Another is gently convex rostrally but is flattened around the margins of the valve (Pl. X, fig. 5). However the internal mould of the latter specimen is flattened dorso-ventrally suggesting that this dorsal valve was originally also gently convex. On the posterior part of this valve (Pl. X, fig. 5) there is a shallow median furrow. Both the ventral and the dorsal valves of the Farley specimens are covered with numerous growth lamellae along which the small spines on the shell are sometimes located; between eight and ten spines per millimetre occur along a growth lamella.

In the ventral valve in the posterior part of the delthyrium there is a small delthyrial plate depressed below the level of the area. The teeth are strong and bulbous. The sockets in the dorsal valve are large and along the inner side of each one there is a robust inner socket ridge. Narrow, less strong ridges lie along the outer margins of the sockets. The crural bases arise from the floor of the valve at the anterior ends of the inner socket ridges. No adductor muscle scars are preserved in the dorsal valves of the Farley specimens but on the internal moulds (UQF54451 and UQF54457) of two valves there are the impressions of a tuberculate cardinal process. The area of attachment of the muscles in the ventral valve is low in comparison with that of most species of *Attenuatella*. It is not an elevated platform with steep sides, but like the ventral muscle fields of Queensland specimens of *Attenuatella convexa* it is characteristically elongate, lying on the floor of the valve posteriorly and being a low rounded elevation anteriorly (Pl. X, fig. 9).

Remarks.—Like specimens of *Attenuatella convexa* from Queensland the Farley specimens possess a low, massive ventral umbo, a broad ventral valve, a distinct ventral sulcus, a gently convex dorsal valve, and quite coarse spines.

One specimen (Pl. X, figs 1, 2) of *Attenuatella* from the Farley Formation at UQL3265 is characterized by a relatively elongate shell and a gently reflexed dorsal valve which is concave in its adult growth stages. The ventral muscle platform is not distinctly elevated but otherwise the specimen is closest to *Attenuatella australis* Armstrong and Brown (1968).

Age.—*Attenuatella convexa* and *A. australis* occur in faunas which are correlatives of Dickins's (1964) Fauna II and for this fauna Armstrong *et al.* (1967) have deduced a lower Artinskian (Aktastinian) age.

ATTENUATELLA MULTISPINOSA Waterhouse, 1967*a*

Specimens.—Several internal and external moulds of ventral and dorsal valves (UQF54417–24, UQF54433–45, UQF54447) from UQL3270. The specimens are preserved in a dark siltstone and are from the upper part of

Voisey's (1936, pp. 159, 160) Upper Division of the Drake Series. For the 1,000 feet of rocks which constitute the upper part of his Upper Division, Voisey (1958, p. 180) proposed the name Gilgurry Mudstone. Additional specimens of *Attenuatella multispinosa* (UQF54425–26, UQF54428–30) from the Gilgurry Mudstone are from UQL3272.

Remarks.—The main distinguishing features of *Attenuatella multispinosa* are its fine spines and the ridges along the margins of the platform of muscular attachment in its ventral valve (Waterhouse, 1967*a*). Waterhouse records spine concentrations of between ten and twenty per millimetre on his specimens of *A. multispinosa.* The specimens of *Attenuatella* from UQL3270 possess narrow elongate ventral valves with imperceptible sulci and reflexed dorsal valves. On some of these ventral valves (i.e. UQF54419, UQF54437 from UQL3270) the spines number between 12 and 16 per millimetre. On a ventral valve (UQF54428) from UQL3272 there are between 14 and 20 spines per millimetre. On any particular ventral valve the finest spines occur on the flanks of the valve near the cardinal extremities. In three ventral valves (UQF54433, UQF54439–40) from UQL3270 there are ridges along the margins of the posterior end of the muscle platform, but in other ventral valves the preserved platforms of muscular attachment are without such ridges (UQF54420, UQF54425–6, UQF54430, UQF54434). However, not all of Waterhouses's specimens of *A. multispinosa* have ridges along the edges of the platform of muscular attachment in the ventral valve (Waterhouse, 1967*a,* Pl. 24, figs 1, 2, & 4). The Gilgurry specimens of *Attenuatella* from UQL3270 and UQL3272 can confidently be assigned to *A. multispinosa.*

Species of *Attenuatella* which have a convexi-concave dorsal valve are *A. incurvata* Waterhouse, *A. multispinosa* Waterhouse, and *A. australis* Armstrong and Brown. The last species has a more prominent ventral sulcus than either of the preceding species and it generally has coarser spines than *A. multispinosa. Attenuatella incurvata* and *A. multispinosa* are very similar species. Waterhouse (1967*a*) distinguished them on the basis of the size of their superficial spines and the degree of development of the ridges along the margins of the platform of muscular attachment in their ventral valves. Along concentric lines on its shell, *Attenuatella incurvata* may have six to eight spines per millimetre (Waterhouse, 1964, p. 111), ten to 13 spines per millimetre (Landis and Waterhouse, 1966, p. 145), or ten to 14 spines per millimetre (Waterhouse, 1967*a,* p. 171). As noted previously, marginal ridges are variably developed on the ventral muscle platforms of the Gilgurry specimens of *Attenuatella,* so that the characteristics of the external ornament and of the ventral muscle platform of the Gilgurry specimens would not seem to enable confident separation of *A. multispinosa* from *A. incurvata.* Should the spines of *A. incurvata* number up to 14 per millimetre, many of the specimens of *Attenuatella* from the Gilgurry Mudstone (i.e. those lacking muscle platform ridges) would be inseparable from the New Zealand species.

In any case *Attenuatella multispinosa* is particularly close to *A. incurvata* and its occurrence in the Gilgurry Mudstone will lend support to a correlation of the fauna in this unit with faunas in which *A. incurvata* occurs elsewhere. In New Zealand *Attenuatella incurvata* occurs in the AG4 Limestone in the Arthurton Group, and in the Pine Bush Formation in the Kuriwao Group (Waterhouse, 1964). The species occurring with *A. multispinosa* in the Gilgurry Mudstone are characteristic of Fauna IV of Dickins (1964; see Runnegar, 1967), and the similarity of *A. multispinosa* to *A. incurvata* supports Runnegar's (1967) and Runnegar and Armstrong's (in press) correlation of Fauna IV with Waterhouse's (1967*b,* p. 166) New Zealand faunas that contain *A. incurvata.*

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EXPLANATION OF PLATE X

All Figures × 5 except Figure 5 which is natural size.

Figs 1, 2. *Attenuatella sp.* cf. *A. australis* Armstrong and Brown; 1, dorsal view of the latex cast of a dorsal valve and the umbo of its conjoined ventral valve. 2, ventral view of the internal mould of the shell which yielded the external mould from which the cast in Figure 1 was taken. UQF54454 from the Farley Formation at UQL3265.

Fig. 3. *Attenuatella convexa* Armstrong; Latex cast of the exterior of a ventral valve. UQF54457 from the Farley Formation at ULQL3265.

Fig. 4. *A. convexa* Armstrong; dorsal view of a latex cast of a dorsal valve and part of its conjoined ventral valve. UQF54451 from the Farley Formation at UQL3265.

Figs 5–7. *A. convexa* Armstrong; 5, 6, dorsal views (natural size and × 5 respectively) of a latex cast of a dorsal valve and its conjoined ventral valve. 7, dorsal view of the internal mould of the shell which yielded the external mould from which the cast in Figures 5 and 6 was taken. UQF54457 from the Farley Formation at UQL3265.

Figs 8, 9. *A. convexa* Armstrong; 8, latex cast of the exterior of a ventral valve. 9, internal mould of the ventral valve whose exterior is illustrated in Figure 8. UQF54452 from the Farley Formation at UQL3265.

Fig. 10. *Attenuatella multispinosa* Waterhouse; dorsal view of the latex cast of a dorsal valve and the umbo of its conjoined ventral valve. UQF54441 from the Gilgurry Mudstone at UQL3270.

Fig. 11. *A. multispinosa* Waterhouse; lateral view of the latex cast of a shell. UQF54423 from the Gilgurry Mudstone at UQL3270.

Fig. 12. *A. multispinosa* Waterhouse; Internal mould of a ventral valve. UQF54434 from the Gilgurry Mudstone at UQL3270.

Figs 13–15. *A. multispinosa* Waterhouse; latex casts of the exteriors of three ventral valves. UQF54419 from UQL3270, UQF54437 from UQL3270, and UQF54428 from UQL3272 respectively, all from the Gilgurry Mudstone.

Fig. 16. *A. multispinosa* Waterhouse; latex cast of the exterior of a dorsal valve. UQF54417 from the Gilgurry Mudstone at UQL3270.

Fig. 17. *A. multispinosa* Waterhouse; internal mould of a ventral valve. AMF42105 from the Gilgurry Mudstone. See also Waterhouse, 1967*a*, Pl. 24, Fig. 3.